volts, and hysterical crises result. The patient alternately passionately repudiates her sexual instincts and brazenly asserts them. It is hard to imagine how a creature without memory or logic could perform all the mental processes involved in this assimilation and repudiation.

Weininger now turns on man. Woman is nothing, and therefore non-moral, not immoral; but man in his relations with her is always immoral. For he always regards her as a means to an end, and not as an end in itself; in sexual congress as the instrument of pleasure and physical reproduction; in love as the instrument of self projection and mental reproduction; but woman is part of humanity, and must be regarded as an end in herself. The present writer, for one, fails to comprehend how a person who has no ego and is nothing can be regarded as an end in herself!

Specious and persuasive as our author shows that he can be, it is clear that he is very far from establishing his principle. The book is a remarkable one for the author's years—he was only twenty-one when he wrote it—remarkable in the learning and thought which he brings to bear no less than in the largeness of its conception and the breadth with which the matter is treated. It is brilliantly written, and contains at once profound reflections and almost laughably unfounded statements of fact. It is at times stimulating and suggestive, but, nevertheless, often irritating, because the central idea seems rather an obsession of a brilliant but inexperienced mind than a conception to which the writer has been driven by carefully considered facts.

Weininger died by his own hand in 1903, and we are told by the friend who collected his posthumous papers that he felt within him criminal tendencies, and could no longer continue the struggle between these tendencies (*Nichts*) and his intelligible ego (*All*).

L. A.

SOME RECENT LOGARITHMIC TABLES.

Tableaux logarithmiques, A et B. By Dr. A. Guillemin. Pp. 48 of explanation, with two tables 35×35 and 46×35 cm. (Paris: Félix Alcan, 1906.) Price 4 francs complete.

Clive's Mathematical Tables. Pp. 49. (London: University Tutorial Press, Ltd., 1906.) Price 1*s.* 6*d.*

Five-figure Mathematical Tables for School and Laboratory Purposes. By Dr. A. Du Pré Denning. Pp. 21. (London: Longmans, Green and Co., 1906.) Price 2*s.* net.

DR. GUILLEMIN'S two tables possess several interesting features. Taking, in the first place, Table A, which is used for working to six places of decimals, this contains the *antilogarithms*, calculated to six decimal places, of all decimals of three places from 0·000 to 0·999. In a third column are given the values of log α, corresponding to values of $\log(1+\alpha)$, from 0·000000 to 0·000999. When it is required to calculate logarithms to six places of decimals, the principle employed is as follows:—Let N be the number the logarithm of which is required, m the nearest number in the column of antilogarithms, so that $\log m = \log N$ to three places of decimals. Then if $N = m(1+\alpha)$ we have

$$\log N = \log m + \log(1+\alpha).$$

By subtraction we find $N - m$, which is equal to $m\alpha$. From the tables we can find by inspection $\log m\alpha$ to *three* decimal places, and subtracting $\log m$, which is known, we have $\log \alpha$ to three decimal places. The table then gives $\log(1+\alpha)$ to three significant figures, and these figures are the second three decimals to be written after $\log m$ in order to give $\log N$ to six places.

In the second table (Table B) the values of the antilogarithms are given to nine places of decimals, and the values of $\log \alpha$ to six places. In each table the number of entries is one thousand, the logarithms going from 0·000 to 0·999. With Table B, which measures 35 cm. by 46 cm., it is possible to calculate any logarithm to nine decimal places, but the work involves something more than a repetition of the process used for Table A. If, for example, it is required to find log 7, there is no difficulty in obtaining the first six figures 0·845098, but the remainder to be operated on in order to find the next three figures cannot be got until we have worked the whole thing backwards and calculated the antilogarithm of 0·845098 to nine decimal places.

It is not often that logarithmic calculations have to be taken to nine decimal places, but if this has to be done the present method, which is very fully explained by the author, avoids the use of cumbersome books of tables, and it will probably be found, with a little practice, not to take much longer—perhaps not even to take so long as the interpolation methods which such books of tables would necessarily involve.

The other tables under review are good examples of a number of small tables which have been issued during the last few years with the object of saving elementary students in mathematics, as well as students in physics and chemistry, from the tedious work of looking out seven-figure logarithms in the large "Chambers." It has been felt for a long time past that working with four figures is sufficient for teaching purposes; on the other hand, the student of experimental science often requires the additional accuracy obtained by an extra decimal place. But though several cheap books of four-figure tables have been issued during the past few years, we had to retain "Chambers" for teaching and examining junior students until about four months ago, as none of the other books we saw contained what was necessary. One contained natural sines and cosines, but not their logarithms; another contained natural and logarithmic sines, but no cosines.

Junior students are very fond of using natural sines when they ought to learn to use their logarithms. They invariably get inaccurate results, by clumsy methods, and it would not be a bad plan to remove the tables of natural sines from the books supplied for examinations.

The proper arrangement for a table of trigono-

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metric logarithms is one which shows clearly the dual use of the tables for reading off the logarithmic sines of angles and the logarithmic cosines of their complements. With small books of tables this is best done by using the right-hand column and top line for logarithmic sines, the left-hand column and bottom line for logarithmic cosines. This is the arrangement adopted by Dr. Briggs in his "Clive's Mathematical Tables." The same arrangement is followed in regard to tangents and co-tangents. The tables of secants and cosecants are another desirable feature. By adding the logarithm of a cosecant instead of subtracting the logarithm of a sine, many compound expressions may be calculated by a single addition sum. It is a pity that logarithms of reciprocals are not also given. The tables are given to five places, and corrections are given in all of them where the differences are irregular. The explanatory matter is very useful to students, notably the definition of significant figures.

Dr. Denning, in his introduction, remarks that "Criticisms and suggestions for future editions will be welcomed." The first criticism which suggests itself is that a book where logarithms of numbers less than four *have necessarily* to be taken from a table of antilogarithms, and logarithms of numbers greater than four from a table of logarithms, is far too ingenious to put into the hands of a beginner. The object of this arrangement is, of course, to avoid the large and irregular differences that occur with logarithms of the lower numbers and antilogarithms of the higher ones. If the book is *not* meant for beginners the arrangement is good, but for teaching the use of tables the complete tables of logs. and antilogs. should be given, and students should be taught later on when to use each. The insertion of corresponding tables for obtaining logarithms of reciprocals is a good feature. It seems rather curious that no one has adopted the plan of bordering a table of antilogarithms with a bottom line and right-hand column containing the arithmetical complements of the numbers in the top line and left-hand column. Such an antilogarithm table would give logarithms of reciprocals very simply.

The arrangement of the trigonometrical tables is not very clear. There are no head- or footlines to the middle page, and while the columns look to run on from one page to the next, they do not really do so. The left-hand column of the first two pages goes from 0° to 15°, and we naturally expect to find 15° to 30° on the next page, but instead of that we find 30° to 45°, the entries for 15° to 30° being on the right-hand column of the first two pages. The misprint "co-functions" at the foot of p. 16 does not really introduce additional confusion. The book contains tables of squares and cubes for those who like to indulge in such luxuries. Pages of physical and chemical constants, electric units and data, together with some of the differentiation and integration formulæ also given, are really useful, and, finally, some "simpler mechanical relationships" and statements of the binomial and Maclaurin's theorems would be of greater value to the average student if they bore the heading "Things that Ought Not to be Learnt."

These criticisms do not preclude us from stating that the tables will be very useful to such science students as have learnt to find their way about in them.

GEOGRAPHY AS A LIVING SCIENCE.

Beobachtung als Grundlage der Geographie. By Prof. Albrecht Penck. Pp. 63. (Berlin: Gebrüder Borntraeger, 1906.) Price 1.60 marks.

THIS little work, which is choicely printed, is a record of a delightful personality. It contains the parting address of Prof. Penck to the students of Vienna, and his introduction to those of Berlin, now the suzerain-city of the land where he was born. The first words, "Liebe Freunde," ring very truly in our ears, and the title of the pamphlet recalls to those friends scenes in very many lands. Especially prized by the present writer is a little photograph—a mere imperfect sketch, if you will—in which Prof. Penck is seen writing up his notes in the open air, on the very edge of one of the world's great landscapes, where the scarp of the African tableland goes suddenly down towards the sea. Like his distinguished botanical colleague, Prof. Engler, Penck has realised the tradition of Humboldt, and has felt that the German people "darf sich in geographischer Arbeit nicht auf sein Gebiet beschränken, es muss solche auf der ganzen Erde leisten" (p. 60).

The striking contrast of geographical position makes it necessary to urge the claims of travel more strongly in Berlin than in Vienna. The romance of Vindobona and Carnuntum, of the Germanised city facing the great "Kessel, in den sich Völkerwoge auf Völkerwoge stürzte," calls us eastward in the first few pages, and we ask ourselves, What has Berlin to offer after this? In the last pages, however, we meet our answer—Germany centres in the flat land of Berlin, but Germany has spread her wings. Near the North Pole lies King William Land, near the South Pole lies Emperor William II. Land, and the union of the German States has allowed all Germany to look towards the sea. On this medium, which no longer divides but joins the continents, we trust that ships may bear in all directions the students of Berlin, imbued as they cannot fail to be with the high and genial spirit of their master.

In the Austrian section of the pamphlet, Prof. Penck shows how tectonic geography has specially developed in Vienna. He urges, however, that the relations between internal structure and surface-features are not always so close as has been supposed. The forms associated with the higher regions of the Alps are thus due less to the recent folding of the chain than to the surface-action of the glaciers of the Ice age and of modern times (p. 16), which continuously carry away, by a nibbling action, fragments from the valley-walls. The author believes that the Alps were far more rounded before the advent of the Ice age, though they possessed (p. 20) a much

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